Deutsches Institut für Bautechnik

Public-law institution jointly founded by the federal states and the Federation

European Technical Assessment Body for construction products

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European Technical Assessment ETA-25/0120 of 11 April 2025

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	ICCONS® THRU-BOLT™ ULTRA / ULTRA A4 / ULTRA HCR
Product family to which the construction product belongs	Mechanical fasteners for use in concrete
Manufacturer	ICCONS 383 Frankston-Dandenong Road Dandenong South VIC 3175 VICTORIA AUSTRALIEN
Manufacturing plant	Plant 2, Germany
This European Technical Assessment contains	24 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330232-01-0601-v05, Edition 01/2024

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Specific Part

1 Technical description of the product

The ICCONS® THRU-BOLT™ ULTRA / ULTRA A4 / ULTRA HCR is a fastener made of zinc plated steel, stainless steel or high corrosion resistant steel which is placed into a drilled hole and anchored by torque-controlled expansion.

The product description is given in Annex A.

2 Specification of the intended use in accordance with the applicable European Assessment Document

The performances given in Section 3 are only valid if the fastener is used in compliance with the specifications and conditions given in Annex B.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the fastener of at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and references to the methods used for its assessment

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistance to tension load (static and quasi-static loading)	see Annex B3, C1, C2
Characteristic resistance to shear load (static and quasi-static loading)	see Annex C3
Characteristic resistance for seismic performance categories C1 and C2	see Annex C4, C5
Displacements	see Annex C8, C9, C10

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	see Annex C6, C7

3.3 Aspects of durability

Essential characteristic	Performance
Durability	See Annex B1

4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

In accordance with the European Assessment Document EAD 330232-01-0601-v05 the applicable European legal act is: 1996/582/EC.

The system to be applied is: 1

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 11 April 2025 by Deutsches Institut für Bautechnik

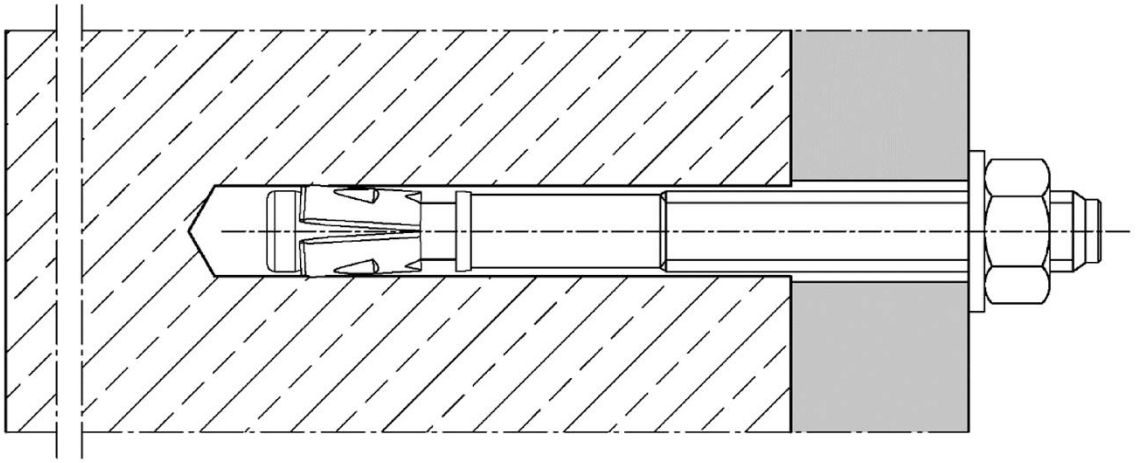
Dipl.-Ing. Beatrix Wittstock
Head of Section

beglaubigt:
Baderschneider

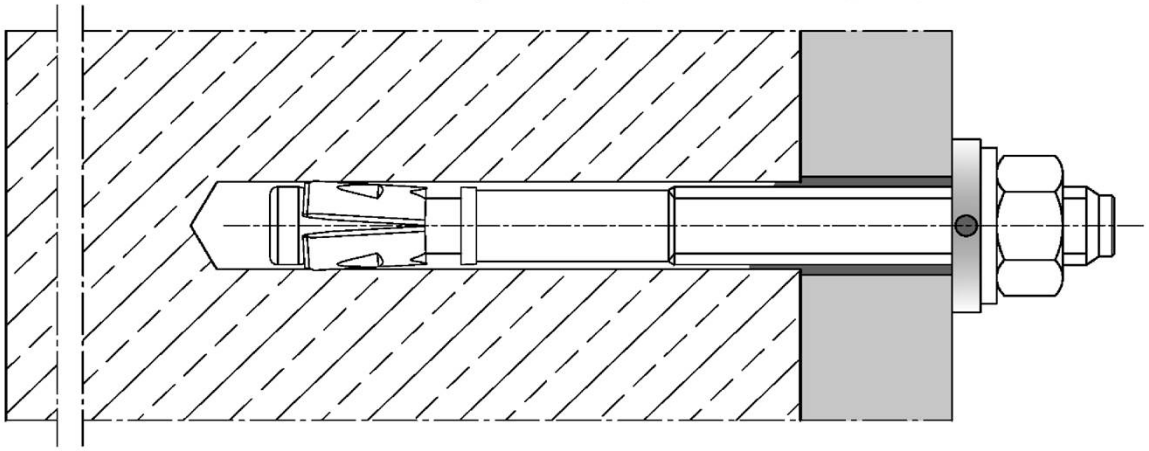
Deutsches Institut für Bautechnik DIBt

ICCONS® THRU-BOLT™ ULTRA / ULTRA A4 / ULTRA HCR

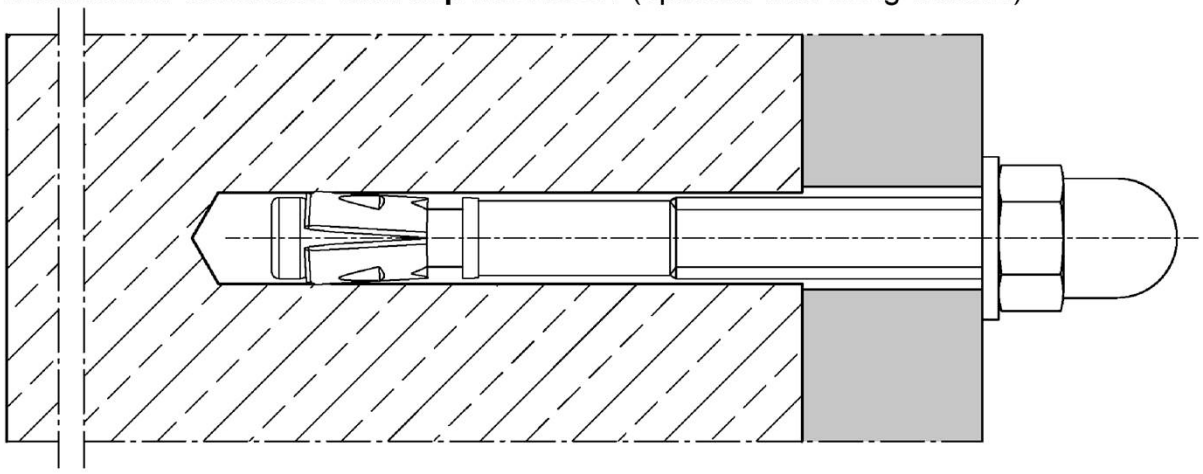
Installation condition



Installation condition with filling washer (optional with cap nut)

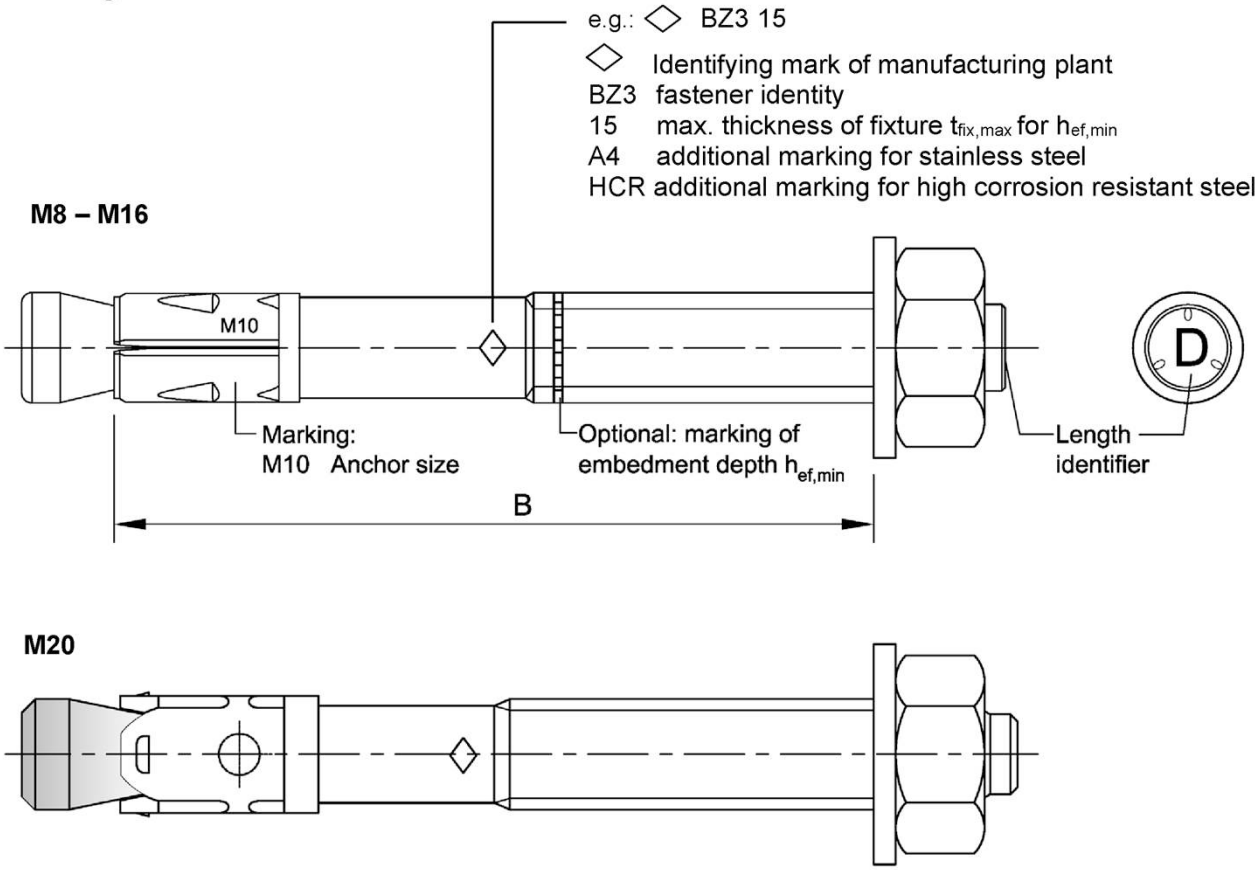


Installation condition with cap nut ASCN (optional with filling washer)



ICCONS® THRU-BOLT™ ULTRA / ULTRA A4 / ULTRA HCR	Annex A1
Product description Product types and installation conditions	

Marking



Usable length: $B = h_{ef} + t_{fix}$

h_{ef}: (existing) effective anchorage depth

t_{fix}: fixture thickness (including e.g. levelling layers or other non-load-bearing layers or additional filling washer)

Table A1: Length identification

Length identifier		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Usable length B	≥	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105

Length identifier		P	Q	R	S	T	U	V	W	X	Y	Z	AA	BB	CC	DD
Usable length B	≥	110	115	120	125	130	135	140	145	150	160	170	180	190	200	210

Length identifier		EE	FF	GG	HH	II	JJ	KK	LL
Usable length B	≥	220	230	240	250	260	270	280	290

Dimensions in mm

ICCONS® THRU-BOLT™ ULTRA / ULTRA A4 / ULTRA HCR

Annex A2

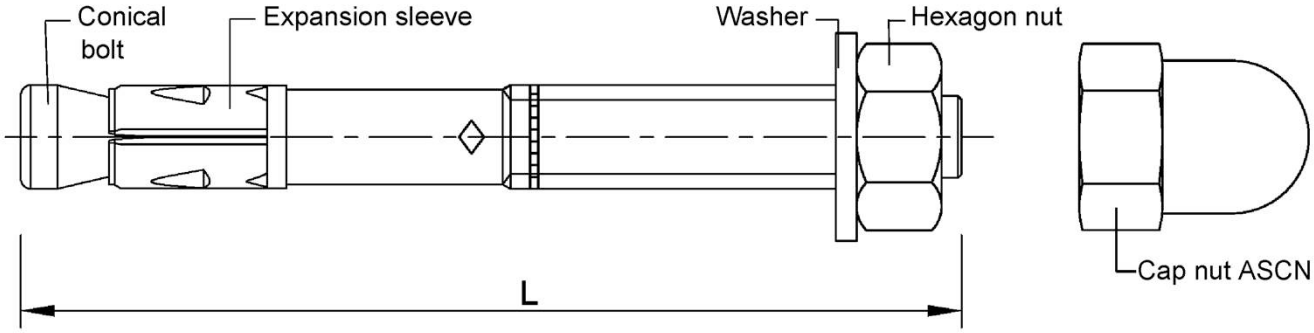
Product description
Marking

Table A2: Material

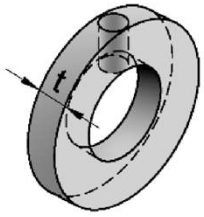
Part	ULTRA	ULTRA A4	ULTRA HCR
	Steel, zinc plated	**Stainless steel CRC III**	**High corrosion resistant steel CRC V**
Conical bolt	Steel, galvanized ≥ 5 µm fracture elongation A_5 ≥ 8%	Stainless steel fracture elongation A_5 ≥ 8%	High corrosion resistant steel fracture elongation A_5 ≥ 8%
Expansion sleeve	Stainless steel	Stainless steel	Stainless steel
Washer	Steel, galvanized ≥ 5 µm	Stainless steel	High corrosion resistant steel
Filling washer CFW			
Hexagon nut			
Cap nut ASCN			

Table A3: Fastener dimensions

Fastener size			ULTRA / ULTRA A4 / ULTRA HCR				
			M8	**M10**	**M12**	**M16**	**M20**
Width across hexagon nut / cap nut ASCN	s	[mm]	13	17	19	24	30
Length of fastener	L	[mm]	h_{ef} + t_{fix} + 18,0	h_{ef} + t_{fix} + 21,5	h_{ef} + t_{fix} + 26,0	h_{ef} + t_{fix} + 33,0	h_{ef} + t_{fix} + 37,0
Thickness of Filling washer CFW	t	[mm]	5				



Filling washer CFW



Reducing adapter

ICCONS® THRU-BOLT™ ULTRA / ULTRA A4 / ULTRA HCR

Product description
Material and dimensions

Annex A3

Specifications of intended use

ICCONS® THRU-BOLT™ ULTRA	ULTRA / ULTRA A4 / ULTRA HCR				
	M8	M10	M12	M16	M20
Static or quasi-static action	✓				
Seismic performance categories C1 and C2	✓				
Fire exposure	R30 / R60 / R90 / R120				
Variable, effective anchorage depth	35 mm to 90 mm	40 mm to 100 mm	50 mm to 125 mm	65 mm to 160 mm	90 mm to 140 mm

Base materials:

- For all anchor sizes: compacted reinforced or unreinforced normal weight concrete according to EN 206:2013+A2:2021
- For anchor sizes M8 to M10: steel fibre reinforced concrete (SFRC) according to EN 206:2013+A2:2021 including steel fibres according to EN 14889-1:2006, clause 5, group I. The maximum content of steel fibres is 80 kg/m^3.
- Cracked or uncracked concrete
- Strength classes C20/25 to C50/60 according to EN 206:2013+A2:2021

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions: all materials
- For all other conditions corresponding to corrosion resistance classes CRC according to EN 1993-1-4:2006 + A1:2015: stainless steel according to Annex A3, Table A2 of this ETA

Design:

- Anchorages are designed under the responsibility of an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored.
  The position of the fastener is indicated on the design drawings (e.g. position of the fastener relative to reinforcement or to supports, etc.).
- Design method EN 1992-4:2018 and Technical Report TR 055:2018

Installation:

- Hole drilling by hammer drill bit or vacuum drill bit
- Use of the fastener only as supplied by the manufacturer without exchanging the components of the fastener (exception: when using the cap nut ASCN)
- The anchor can be set in pre- or through-setting installation.
- Optionally, the annular gap between fixture and stud of ULTRA can be filled to reduce the hole clearance. For this purpose, the filling washer (Annex A3) must be used in addition to the supplied washer. For filling use Injection Adhesive BIS-HY Hybrid Gen2, BIS-V Vinylester or other high-strength injection mortar with compressive strength ≥ 40N/mm².

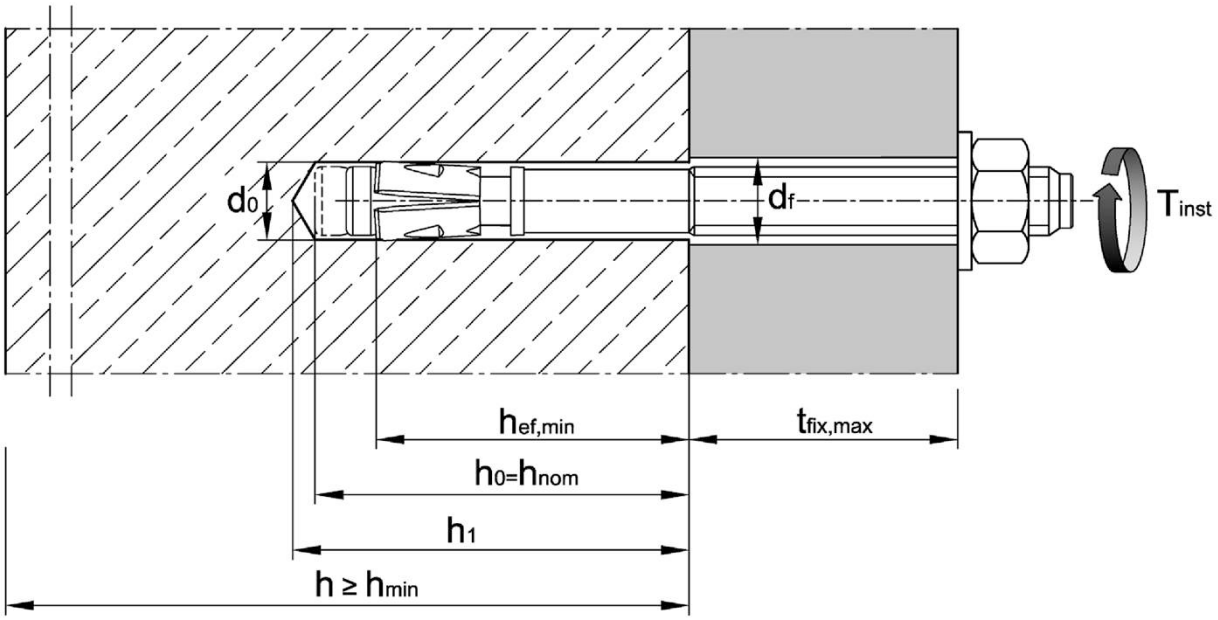
ICCONS® THRU-BOLT™ ULTRA / ULTRA A4 / ULTRA HCR	Annex B1
Intended use Specifications	

Table B1: Installation parameters

Anchor size				ULTRA / ULTRA A4 / ULTRA HCR				
				M8	M10	M12	M16	M20
Nominal drill hole diameter		d_0	[mm]	8	10	12	16	20
Cutting diameter of drill bit		$d_{cut} \leq$	[mm]	8,45	10,45	12,5	16,5	20,55
Minimum effective anchorage depth		$h_{ef,min}$	[mm]	35	40	50	65	90
Maximum effective anchorage depth		$h_{ef,max}$	[mm]	90	100	125	160	140
Depth of drill hole	$h_{nom} = h_0 \geq$		[mm]	h_{ef} + 8	h_{ef} + 9	h_{ef} + 10	h_{ef} + 14	h_{ef} + 14 (h_{ef} + 28)[1]
	$h_1 \geq$		[mm]	h_{ef} + 10	h_{ef} + 11	h_{ef} + 13	h_{ef} + 17	h_{ef} + 17 (h_{ef} + 31)[1]
Diameter of clearance hole in the fixture [2]		$d_f \leq$	[mm]	9	12	14	18	22
Projection after anchor has been inserted for installing with cap nut ASCN (acc. to Annex B7, Figure 3)		C	[mm]	10,5	12,5	16,0	19,5	23,0
Installation torque	ULTRA	T_{inst}	[Nm]	15	40	60	110	160
	ULTRA A4 / HCR	T_{inst}	[Nm]	15	40	55	100	200

[1] Increased drill hole depth for hammer drilling without borehole cleaning.

[2] For larger diameters of clearance hole in the fixture, see EN 1992-4:2018, chapter 6.2.2.2



ICCONS® THRU-BOLT™ ULTRA / ULTRA A4 / ULTRA HCR

Intended use
Installation parameters

Annex B2

Table B2: Minimum thickness of concrete member, minimum spacings, edge distances

Anchor size			ULTRA / ULTRA A4 / ULTRA HCR				
			M8	M10	M12	M16	M20
Minimum member thickness depending on h_{ef}	$h_{min} \geq$	[mm]	max (1,5·h_{ef} ; 80)		max (1,5·h_{ef}; 100)	max (1,5·h_{ef}; 120)	max (1,5·h_{ef}; 150)
Minimum edge distances and spacings							
Minimum edge distance	c_{min}	[mm]	40	45	55	65	90
	for s ≥	[mm]	see Table B4				
Minimum spacings	s_{min}	[mm]	35	40	50	65	95
	for c ≥	[mm]	see Table B4				

The following equation must be fulfilled for the calculation of the minimum spacing and edge distance during installation in combination with variable anchorage depth and member thickness:

$$A_{sp,rqd} \leq A_{sp,ef}$$

Required splitting area $A_{sp,rqd}$ and idealized splitting area $A_{sp,ef}$ according to Table B4.

Table B3: Applicable concrete thickness h_{sp} and area A_{sp} to determine characteristic edge distance $c_{cr,sp}$

Anchor size				ULTRA / ULTRA A4 / ULTRA HCR				
				M8	M10	M12	M16	M20
Applicable concrete thickness	ULTRA ULTRA A4 ULTRA HCR	h_{sp}	[mm]	$\min(h\ ;\ h_{ef} + 1{,}5 \cdot c \cdot \sqrt{2})$				
Area to determine $c_{cr,sp}$ [1)]	ULTRA	A_{sp}	[mm²]	$\frac{N^0_{Rk,sp} - 2{,}573}{0{,}000436}$	$\frac{N^0_{Rk,sp} + 2{,}040}{0{,}000693}$	$\frac{N^0_{Rk,sp} + 3{,}685}{0{,}000692}$	$\frac{N^0_{Rk,sp} + 3{,}738}{0{,}000875}$	$\frac{N^0_{Rk,sp} + 2{,}423}{0{,}000453}$
	ULTRA A4 ULTRA HCR	A_{sp}	[mm²]	$\frac{N^0_{Rk,sp} + 4{,}177}{0{,}000862}$	$\frac{N^0_{Rk,sp} + 7{,}235}{0{,}000967}$	$\frac{N^0_{Rk,sp} + 7{,}847}{0{,}000951}$	$\frac{N^0_{Rk,sp} + 11{,}41}{0{,}000742}$	$\frac{N^0_{Rk,sp} + 2{,}423}{0{,}000453}$

[1)] With $N^0_{Rk,sp}$ in kN

ICCONS® THRU-BOLT™ ULTRA / ULTRA A4 / ULTRA HCR	Annex B3
Intended use Minimum spacings and edge distances Required area and applicable concrete thickness	

Table B4: Areas to determine spacings and edge distances for installation

Anchor size				ULTRA / ULTRA A4 / ULTRA HCR				
				M8	M10	M12	M16	M20
The following equation must be fulfilled for the calculation of the minimum spacing and edge distance during installation in combination with variable anchorage depth and member thickness: $A_{sp,rqd} \leq A_{sp,ef}$								
Idealized splitting area $A_{sp,ef}$ The edge distances and spacings shall be selected or rounded in steps of 5 mm.								
Member thickness: $h > h_{ef} + 1{,}5 \cdot c$								
Single anchor or anchor group with **$s \geq 3 \cdot c$**								
Idealized splitting area		$A_{sp,ef}$	[mm²]	$(6 \cdot c) \cdot (1{,}5 \cdot c + h_{ef})$				
Anchor group ($s < 3 \cdot c$)								
Idealized splitting area		$A_{sp,ef}$	[mm²]	$(3 \cdot c + s) \cdot (1{,}5 \cdot c + h_{ef})$				
Member thickness: $h \leq h_{ef} + 1{,}5 \cdot c$								
Single anchor or anchor group with **$s \geq 3 \cdot c$**								
Idealized splitting area		$A_{sp,ef}$	[mm²]	$(6 \cdot c) \cdot h$				
Anchor group ($s < 3 \cdot c$)								
Idealized splitting area		$A_{sp,ef}$	[mm²]	$(3 \cdot c + s) \cdot h$				
Required splitting area $A_{sp,rqd}$								
ULTRA	cracked concrete	$A_{sp,rqd}$	[mm²]	13 900	23 700	31 500	42 300	91 250
	uncracked concrete	$A_{sp,rqd}$	[mm²]	22 500	34 700	41 300	50 200	110 000
ULTRA A4 ULTRA HCR	cracked concrete	$A_{sp,rqd}$	[mm²]	16 900	25 900	29 800	44 300	91 250
	uncracked concrete	$A_{sp,rqd}$	[mm²]	19 700	35 700	35 300	54 800	110 000

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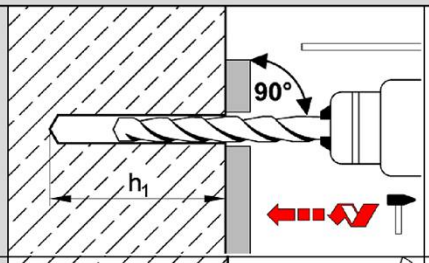
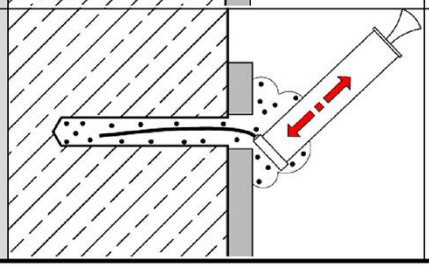
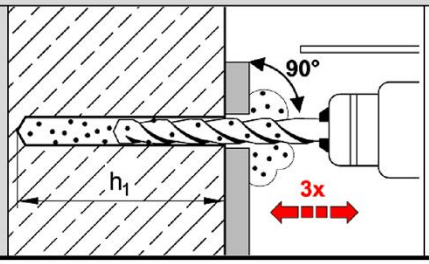
Installation instructions

Hole drilling with cleaning

1		**Hammer drilling or vacuum drilling:** Drill hole perpendicular to concrete surface. If using a vacuum drill bit, proceed with step 3.
2		Blow out dust. Alternatively vacuum clean down to the bottom of the hole.

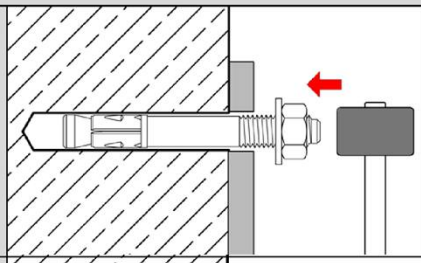
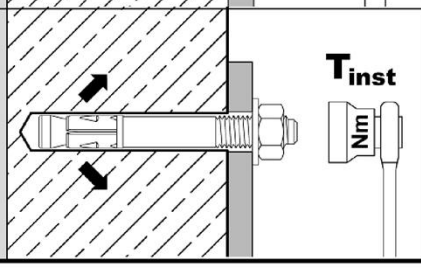
Hammer drilling without cleaning (M20)

1		When the drill hole depth (h_1= h_{ef} +31mm) is reached, move the drill back and forth at least three times with the machine switched on to remove the dust in the drill hole (venting the drill hole). Continue with step 3.

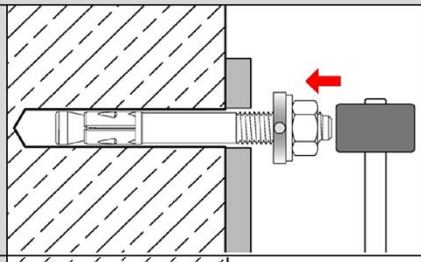
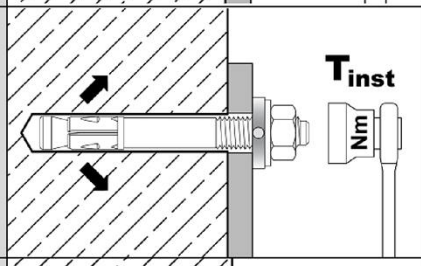
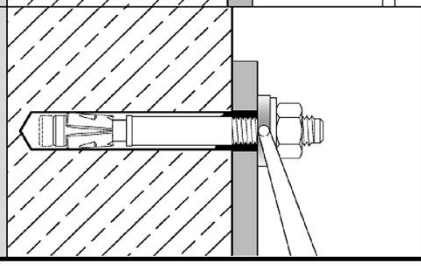
ICCONS® THRU-BOLT™ ULTRA / ULTRA A4 / ULTRA HCR	**Annex B5**
Intended use Installation instructions – hole drilling and cleaning	

Installation instructions - continuation

Insert fastener

3		Drive in fastener.
4		Apply installation torque T_{inst}.

Insert fastener with filling of annular gap

3		Drive in fastener with additionally mounted filling washer.
4		Apply installation torque T_{inst}.
5		Fill the annular gap between anchor and fixture with injection adhesive (see Annex B1). Use enclosed reducing adapter. The annular gap is completely filled, when excess mortar seeps out.

ICCONS® THRU-BOLT™ ULTRA / ULTRA A4 / ULTRA HCR	
Intended Use Installation instructions - set fastener	**Annex B6**

Installation instruction – continuation

Install fastener with cap nut ASCN

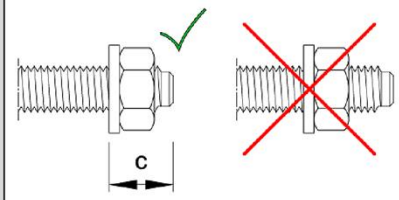
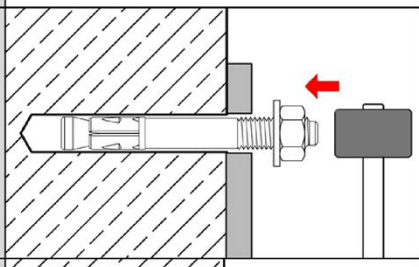
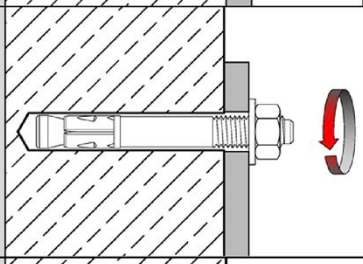
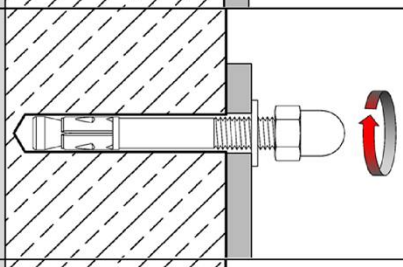
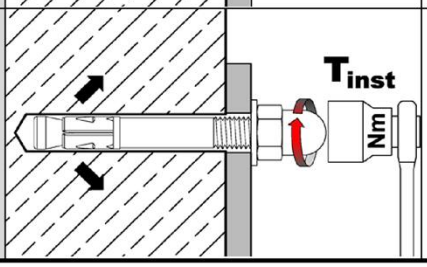
3		Check position of nut. Projection C after anchor has been inserted see Annex B2, Table B1.
4		Drive in fastener.
5		Remove nut.
6		Screw on cap nut ASCN.
7		Apply installation torque T_{inst}.

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Table C1: Characteristic values for **tension loads** under static and quasi-static action, **ULTRA** (steel, zinc plated)

Fastener size			**ULTRA**				
			M8	**M10**	**M12**	**M16**	**M20**
Installation factor	γ_{inst}	[-]	1,0				
Steel failure							
Characteristic resistance	$N_{Rk,s}$	[kN]	19,8	30,4	44,9	79,3	126,2
Partial factor [4]	γ_{Ms}	[-]	1,5				
Pull-out							
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p,cr}$	[kN]	9,5	15	22	30	45
Increasing factor $N_{Rk,p,cr} = \psi_C \bullet N_{Rk,p,cr}$ (C20/25)	ψ_C	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,439}$	$\left(\frac{f_{ck}}{20}\right)^{0,265}$	$\left(\frac{f_{ck}}{20}\right)^{0,5}$	$\left(\frac{f_{ck}}{20}\right)^{0,339}$	$\left(\frac{f_{ck}}{20}\right)^{0,338}$
Characteristic resistance in uncracked concrete C20/25	$N_{Rk,p,ucr}$	[kN]	14	24	30	50	55
Increasing factor $N_{Rk,p,ucr} = \psi_C \bullet N_{Rk,p,ucr}$ (C20/25)	ψ_C	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,489}$	$\left(\frac{f_{ck}}{20}\right)^{0,448}$	$\left(\frac{f_{ck}}{20}\right)^{0,5}$	$\left(\frac{f_{ck}}{20}\right)^{0,203}$	$\left(\frac{f_{ck}}{20}\right)^{0,5}$
Splitting							
Characteristic resistance	$N^0_{Rk,sp}$	[kN]	min ($N_{Rk,p}$; $N^0_{Rk,c}$ [3])				
Characteristic edge distance [2]	$c_{cr,sp}$	[mm]	$min\left(\frac{A_{sp}+0,8\cdot(h_{sp}-h_{ef})^2}{(3,41\cdot h_{sp}-0,59\cdot h_{ef})};\frac{A_{sp}}{h_{sp}\cdot\sqrt{8}}\right) \geq 1,5\cdot h_{ef}$				
Characteristic spacing	$s_{cr,sp}$	[mm]	2 · $c_{cr,sp}$				
Factor	$\psi_{h,sp}$	[-]	1,0				
Concrete cone failure							
Minimum, effective anchorage depth	$h_{ef,min}$	[mm]	35 [1]	40	50	65	90
Maximum, effective anchorage depth	$h_{ef,max}$	[mm]	90	100	125	160	140
Characteristic edge distance	$c_{cr,N}$	[mm]	1,5 · h_{ef}				
Characteristic spacing	$s_{cr,N}$	[mm]	2 · $c_{cr,N}$				
Factor — cracked concrete	$k_{cr,N}$	[-]	7,7				
Factor — uncracked concrete	$k_{ucr,N}$	[-]	11,0				

[1] Fastenings with anchorage depth h_{ef} < 40mm are restricted to the use of structural components which are statically indeterminate and subject to internal exposure conditions only.

[2] Applicable concrete thickness h_{sp} and area A_{sp} to determine characteristic edge distance $c_{cr,sp}$ according to Table B3

[3] $N^0_{Rk,c}$ according to EN 1992-4:2018

[4] In absence of other national regulations

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Table C2: Characteristic values for **tension loads** under static or quasi-static action, **ULTRA A4** and **ULTRA HCR**

Fastener size			**ULTRA A4 / ULTRA HCR**				
			M8	**M10**	**M12**	**M16**	**M20**
Installation factor	γ_{inst}	[-]	1,0				
Steel failure							
Characteristic resistance	$N_{Rk,s}$	[kN]	19,8	30,4	44,9	74,6	126,2
Partial factor [4]	γ_{Ms}	[-]	1,5				
Pull-out							
Characteristic resistance in cracked concrete C20/25	$N_{Rk,p,cr}$	[kN]	9,5	17	22	35	45
Increasing factor $N_{Rk,p,cr} = \psi_C \cdot N_{Rk,p,cr}$ (C20/25)	ψ_C	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,488}$	$\left(\frac{f_{ck}}{20}\right)^{0,5}$	$\left(\frac{f_{ck}}{20}\right)^{0,435}$	$\left(\frac{f_{ck}}{20}\right)^{0,350}$	$\left(\frac{f_{ck}}{20}\right)^{0,338}$
Characteristic resistance in uncracked concrete C20/25	$N_{Rk,p,ucr}$	[kN]	20	25	42	50	55
Increasing factor $N_{Rk,p,ucr} = \psi_C \cdot N_{Rk,p,ucr}$ (C20/25)	ψ_C	[-]	$\left(\frac{f_{ck}}{20}\right)^{0,240}$	$\left(\frac{f_{ck}}{20}\right)^{0,364}$	$\left(\frac{f_{ck}}{20}\right)^{0,213}$	$\left(\frac{f_{ck}}{20}\right)^{0,196}$	$\left(\frac{f_{ck}}{20}\right)^{0,5}$
Splitting							
Characteristic resistance	$N^0_{Rk,sp}$	[kN]	min ($N_{Rk,p}$; $N^0_{Rk,c}$ [3])				
Characteristic edge distance [2]	$c_{cr,sp}$	[mm]	$min\left(\frac{A_{sp}+0,8\cdot(h_{sp}-h_{ef})^2}{(3,41\cdot h_{sp}-0,59\cdot h_{ef})};\frac{A_{sp}}{h_{sp}\cdot\sqrt{8}}\right) \geq 1,5\cdot h_{ef}$				
Characteristic spacing	$s_{cr,sp}$	[mm]	2 · $c_{cr,sp}$				
Factor	$\psi_{h,sp}$	[-]	1,0				
Concrete cone failure							
Minimum, effective anchorage depth	$h_{ef,min}$	[mm]	35 [1]	40	50	65	90
Maximum, effective anchorage depth	$h_{ef,max}$	[mm]	90	100	125	160	140
Characteristic edge distance	$c_{cr,N}$	[mm]	1,5 · h_{ef}				
Characteristic spacing	$s_{cr,N}$	[mm]	2 · $c_{cr,N}$				
Factor — cracked concrete	$k_{cr,N}$	[-]	7,7				
Factor — uncracked concrete	$k_{ucr,N}$	[-]	11,0				

[1] Fastenings with anchorage depth h_{ef} < 40 mm are restricted to the use of structural components which are statically indeterminate and subject to internal exposure conditions only

[2] Applicable concrete thickness h_{sp} and area A_{sp} according to Table B3 to determine characteristic edge distance $c_{cr,sp}$

[3] $N^0_{Rk,c}$ according to EN 1992-4:2018

[4] In absence of other national regulations

ICCONS® THRU-BOLT™ ULTRA / ULTRA A4 / ULTRA HCR	**Annex C2**
Performance Characteristic values for **tension loads, ULTRA A4** and **ULTRA HCR**	

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Table C3: Characteristic values for **shear loads** under static and quasi-static action

Fastener size				**ULTRA / ULTRA A4 / ULTRA HCR**				
				M8	**M10**	**M12**	**M16**	**M20**
Installation factor		γ_{inst}	[-]	1,0				
Steel failure <u>without</u> lever arm								
Characteristic resistance – **<u>unfilled</u>** annular gap	ULTRA	$V^0_{Rk,s}$	[kN]	15,7	26,8	38,3	60,0	83,8
	ULTRA A4 / HCR	$V^0_{Rk,s}$	[kN]	16,8	27,8	39,8	69,5	108,5
Characteristic resistance – **<u>filled</u>** annular gap	ULTRA	$V^0_{Rk,s}$	[kN]	17,3	26,7	38,6	60,6	86,1
	ULTRA A4 / HCR	$V^0_{Rk,s}$	[kN]	16,8	27,8	44,9	80,1	108,5
Partial factor [2]		γ_{Ms}	[-]	1,25				
Ductility factor		k_7	[-]	1,0				
Steel failure <u>with</u> lever arm								
Characteristic bending resistance	ULTRA	$M^0_{Rk,s}$	[Nm]	30	60	105	240	412
	ULTRA A4 / HCR	$M^0_{Rk,s}$	[Nm]	27	55	99	223	390
Partial factor [2]		γ_{Ms}	[-]	1,25				
Concrete pry-out failure								
Pry-out factor	ULTRA	k_8	[-]	2,8	3,1	3,0	3,6	3,3
	ULTRA A4 / HCR	k_8	[-]	2,7	2,8	3,3	3,4	3,3
Concrete edge failure								
Effective length of fastener in shear loading		l_f	[mm]	h_{ef} [1]				
Outside diameter of fastener		d_{nom}	[mm]	8	10	12	16	20

[1] Fastenings with anchorage depth $h_{ef} < 40$ mm are restricted to the use of structural components which are statically indeterminate and subject to internal exposure conditions only.

[2] In absence of other national regulations.

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Table C4: Characteristic values for **seismic loading,** performance category **C1**

Fastener size				**ULTRA / ULTRA A4 / ULTRA HCR**									
				M8		**M10**		**M12**		**M16**		**M20**	
Effective anchorage depth		$h_{ef} \geq$	[mm]	40	45	40	60	50	70	65	85	90	100
Tension load													
Installation factor		γ_{inst}	[-]	1,0									
Steel failure													
Characteristic resistance	ULTRA	$N_{Rk,s,C1}$	[kN]	19,8		30,4		44,9		79,3		126,2	
	ULTRA A4 / HCR	$N_{Rk,s,C1}$	[kN]	19,8		30,4		44,9		74,6		126,2	
Pull-out													
Characteristic resistance	ULTRA	$N_{Rk,p,C1}$	[kN]	9,1		15,0		22,0		30,0		45,1	
	ULTRA A4 / HCR	$N_{Rk,p,C1}$	[kN]	9,0		17,0		22,0		35,0		45,1	
Shear load													
Steel failure without lever arm													
Characteristic resistance - **unfilled** annular gap	ULTRA	$V_{Rk,s,C1}$	[kN]	11,7	13,4	22,5	24,4	30,0	33,8	48,8	52,3	83,8	
	ULTRA A4 / HCR	$V_{Rk,s,C1}$	[kN]	11,0	12,7	20,6	22,2	33,2	33,2	61,1	64,3	108,5	
Characteristic resistance - **filled** annular gap	ULTRA	$V_{Rk,s,C1}$	[kN]	14,0	14,7	24,1	24,4	37,0	38,6	60,2	60,2	86,1	
	ULTRA A4 / HCR	$V_{Rk,s,C1}$	[kN]	12,6	16,8	24,5	27,5	36,7	39,8	67,7	74,2	108,5	
Factor for anchorages	**unfilled** annular gap	α_{gap}	[-]	0,5									
	filled annular gap	α_{gap}	[-]	1,0									

ICCONS® THRU-BOLT™ ULTRA / ULTRA A4 / ULTRA HCR

Performance
Characteristic resistance for **seismic loading,** performance category **C1**

Annex C4

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Table C5: Characteristic values for **seismic loading,** performance category **C2**

Fastener size				**ULTRA / ULTRA A4 / ULTRA HCR**										
				M8		**M10**		**M12**		**M16**		**M20**		
Effective anchorage depth		$h_{ef} \geq$	[mm]	40	45	40	60	50	70	65	85	90	100	140
Tension load														
Installation factor		γ_{inst}	[-]	1,0										
Steel failure														
Characteristic resistance	ULTRA	$N_{Rk,s,C2}$	[kN]	19,8		30,4		44,9		79,3		126,2		
	ULTRA A4 / HCR	$N_{Rk,s,C2}$	[kN]	19,8		30,4		44,9		74,6		126,2		
Pull-out														
Characteristic resistance	ULTRA	$N_{Rk,p,C2}$	[kN]	2,8	3,6	7,3	12,5	10,7	19,0	19,8	35,2	35,1	37,6	42,9
	ULTRA A4 / HCR	$N_{Rk,p,C2}$	[kN]	2,3	3,2	5,0	7,7	8,0	13,8	19,0	29,4	35,1	37,6	42,9
Shear load														
Steel failure without lever arm														
Characteristic resistance - **unfilled** annular gap	ULTRA	$V_{Rk,s,C2}$	[kN]	7,3	11,3	15,4	19,0	18,3	28,0	39,4	43,3	69,0		
	ULTRA A4 / HCR	$V_{Rk,s,C2}$	[kN]	7,5	8,6	12,5	15,9	22,4	25,6	42,7	46,1	88,9		
Characteristic resistance - **filled** annular gap	ULTRA	$V_{Rk,s,C2}$	[kN]	9,7	10,8	17,7	19,9	27,6	28,9	46,0	48,8	73,3		
	ULTRA A4 / HCR	$V_{Rk,s,C2}$	[kN]	9,4	9,7	16,5	17,1	24,5	28,5	47,4	47,4	88,9		
Factor for anchorages	**unfilled** annular gap	α_{gap}	[-]	0,5										
	filled annular gap	α_{gap}	[-]	1,0										

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Performance
Characteristic resistance for **seismic loading,** performance category **C2**

Annex C5

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Table C6: Characteristic values **for tension and shear load** under **fire exposure, ULTRA** (steel, zinc plated)

Fastener size				**ULTRA**				
				M8	**M10**	**M12**	**M16**	**M20**
Tension load								
Steel failure								
Characteristic resistance	R30	$N_{Rk,s,fi}$	[kN]	1,2	2,6	4,6	7,7	9,4
	R60			1,0	1,9	3,3	5,6	8,2
	R90			0,7	1,3	2,1	3,5	6,9
	R120			0,6	1,0	1,5	2,5	6,3
Shear load								
Steel failure <u>without</u> lever arm								
Characteristic resistance	R30	$V_{Rk,s,fi}$	[kN]	4,0	7,5	12,3	20,7	11,0
	R60			2,7	5,1	8,5	14,2	10,6
	R90			1,4	2,7	4,6	7,7	10,2
	R120			0,8	1,6	2,7	4,5	10,0
Steel failure <u>with</u> lever arm								
Characteristic resistance	R30	$M^0_{Rk,s,fi}$	[Nm]	4,1	9,6	19,1	43,8	29,1
	R60			2,8	6,6	13,1	30,1	28,0
	R90			1,5	3,5	7,2	16,4	26,9
	R120			0,8	2,0	4,2	9,6	26,3

$N_{Rk,p,fi}$ and $N_{Rk,c,fi}$ according to EN 1992-4:2018

ICCONS® THRU-BOLT™ ULTRA / ULTRA A4 / ULTRA HCR

Performance
Characteristic values under **fire exposure, ULTRA** (steel, zinc plated)

Annex C6

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Table C7: Characteristic values **for tension and shear load** under **fire exposure, ULTRA A4** and **ULTRA HCR**

Fastener size				**ULTRA A4 / ULTRA HCR**				
				M8	**M10**	**M12**	**M16**	**M20**
Tension load								
Steel failure								
Characteristic resistance	R30	$N_{Rk,s,fi}$	[kN]	4,0	6,9	11,0	18,1	36,9
	R60			2,9	5,0	8,0	13,1	27,4
	R90			1,8	3,1	4,9	8,1	17,9
	R120			1,2	2,1	3,4	5,6	13,1
Shear load								
Steel failure <u>without</u> lever arm								
Characteristic resistance	R30	$V_{Rk,s,fi}$	[kN]	8,5	17,6	32,0	52,6	73,5
	R60			6,2	12,6	22,6	37,1	51,8
	R90			3,9	7,5	13,1	21,5	30,1
	R120			2,8	5,0	8,4	13,8	19,2
Steel failure <u>with</u> lever arm								
Characteristic resistance	R30	$M^0_{Rk,s,fi}$	[Nm]	8,7	22,7	49,8	111,5	194,7
	R60			6,3	16,2	35,1	78,6	137,2
	R90			4,0	9,7	20,4	45,6	79,7
	R120			2,8	6,5	13,0	29,2	50,9

$N_{Rk,p,fi}$ and $N_{Rk,c,fi}$ according to EN 1992-4:2018

ICCONS® THRU-BOLT™ ULTRA / ULTRA A4 / ULTRA HCR

Performance
Characteristic values under **fire exposure, ULTRA A4** and **ULTRA HCR**

Annex C7

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Table C8: Displacements under **tension load, ULTRA** (steel, zinc plated)

Fastener size			**ULTRA**										
			M8		**M10**		**M12**		**M16**		**M20**		
Displacements under static or quasi-static action $\delta_{N0} = \delta_{N0\text{-factor}} * N$ N: acting tension load $\delta_{N\infty} = \delta_{N\infty\text{-factor}} * N$													
Effective anchorage depth	$h_{ef} \geq$	[mm]	35		40		50		65		90		
Cracked concrete													
Factor for displacement	$\delta_{N0\text{-factor}}$	[mm/kN]	0,13		0,05		0,04		0,03		0,04		
	$\delta_{N\infty\text{-factor}}$	[mm/kN]	0,29		0,20		0,15		0,11		0,05		
Uncracked concrete													
Factor for displacement	$\delta_{N0\text{- factor}}$	[mm/kN]	0,03		0,01		0,004		0,005		0,02		
	$\delta_{N\infty\text{- factor}}$	[mm/kN]	0,03		0,03		0,03		0,03		0,03		
Displacement under seismic action C2													
Effective anchorage depth	$h_{ef} \geq$	[mm]	40	45	40	60	50	70	65	85	90	100	140
Displacements for DLS	$\delta_{N,\ C2(DLS)}$	[mm]	3,9	4,9	2,8	4,7	2,4	4,2	2,5	4,5	4,2	4,5	5,1
Displacements for ULS	$\delta_{N,\ C2(ULS)}$	[mm]	11,3	14,3	9,4	16,1	7,3	12,9	7,2	12,8	11,7	12,5	14,3

Table C9: Displacements under **tension load, ULTRA A4** and **ULTRA HCR**

Fastener size			**ULTRA A4 / ULTRA HCR**										
			M8		**M10**		**M12**		**M16**		**M20**		
Displacements under static or quasi-static action $\delta_{N0} = \delta_{N0\text{-factor}} * N$ N: acting tension load $\delta_{N\infty} = \delta_{N\infty\text{-factor}} * N$													
Effective anchorage depth	$h_{ef} \geq$	[mm]	35		40		50		65		90		
Cracked concrete													
Factor for displacement	$\delta_{N0\text{-factor}}$	[mm/kN]	0,11		0,06		0,05		0,02		0,04		
	$\delta_{N\infty\text{-factor}}$	[mm/kN]	0,27		0,17		0,16		0,08		0,05		
Uncracked concrete													
Factor for displacement	$\delta_{N0\text{- factor}}$	[mm/kN]	0,02		0,00		0,001		0,00		0,02		
	$\delta_{N\infty\text{- factor}}$	[mm/kN]	0,05		0,05		0,05		0,05		0,03		
Displacement under seismic action C2													
Effective anchorage depth	$h_{ef} \geq$	[mm]	40	45	40	60	50	70	65	85	90	100	140
Displacements for DLS	$\delta_{N,\ C2(DLS)}$	[mm]	2,0	2,9	2,6	4,1	3,3	5,7	3,3	5,1	4,2	4,5	5,1
Displacements for ULS	$\delta_{N,\ C2(ULS)}$	[mm]	7,7	11,1	10,8	16,8	10,4	18,0	9,0	13,9	11,7	12,5	14,3

ICCONS® THRU-BOLT™ ULTRA / ULTRA A4 / ULTRA HCR

Performance
Displacements under tension load

Annex C8

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Table C10: Displacements under **shear load, ULTRA** (steel, zinc plated)

Fastener size			**ULTRA**								
			M8		**M10**		**M12**		**M16**		**M20**
Displacements under static or quasi-static action $\delta_{V0} = \delta_{V0\text{-factor}} * V$ V: acting shear load $\delta_{V\infty} = \delta_{V\infty\text{-factor}} * V$											
Effective anchorage depth	$h_{ef} \geq$	[mm]	35		40		50		65		90
Factor for displacement **unfilled** annular gap	δ_{V0}- factor	[mm/kN]	0,15		0,09		0,09		0,07		0,06
	$\delta_{V\infty}$- factor	[mm/kN]	0,22		0,13		0,14		0,11		0,10
Factor for displacement **filled** annular gap	δ_{V0}- factor	[mm/kN]	0,01		0,04		0,06		0,04		0,02
	$\delta_{V\infty}$- factor	[mm/kN]	0,015		0,06		0,09		0,06		0,03
Displacement under seismic action C2 [1] **unfilled** annular gap											
Effective anchorage depth	$h_{ef} \geq$	[mm]	40	45	40	60	50	70	65	85	90
Displacements for DLS	$\delta_{V,C2(DLS)}$	[mm]	2,8	2,7	3,0	3,1	3,4	3,7	3,4	3,8	5,1
Displacements for ULS	$\delta_{V,C2(ULS)}$	[mm]	5,1	5,0	5,0	5,5	6,3	9,9	6,0	9,6	9,4
Displacement under seismic action C2 filled annular gap											
Effective anchorage depth	$h_{ef} \geq$	[mm]	40	45	40	60	50	70	65	85	90
Displacements for DLS	$\delta_{V,C2(DLS)}$	[mm]	0,5	0,4	1,4	0,9	1,4	0,7	1,4	1,2	1,3
Displacements for ULS	$\delta_{V,C2(ULS)}$	[mm]	1,7	1,9	5,8	4,5	4,5	3,1	5,0	3,9	5,2

[1] For anchorages with clearance in the fixture the annular gap must also be taken into account.

ICCONS® THRU-BOLT™ ULTRA / ULTRA A4 / ULTRA HCR

Performance
Displacements under shear load

Annex C9

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Table C11: Displacements under **shear load, ULTRA A4** and **ULTRA HCR**

Fastener size			**ULTRA A4 / ULTRA HCR**								
			M8		**M10**		**M12**		**M16**		**M20**
Displacements under static or quasi-static action $\delta_{V0} = \delta_{V0\text{-factor}} * V$ V: acting shear load $\delta_{V\infty} = \delta_{V\infty\text{-factor}} * V$											
Effective anchorage depth	$h_{ef} \geq$	[mm]	35		40		50		65		90
Factor for displacement **unfilled** annular gap	δ_{V0}- factor	[mm/kN]	0,26		0,14		0,12		0,09		0,09
	$\delta_{V\infty}$- factor	[mm/kN]	0,39		0,20		0,17		0,14		0,13
Factor for displacement **filled** annular gap	δ_{V0}- factor	[mm/kN]	0,16		0,05		0,05		0,03		0,09
	$\delta_{V\infty}$- factor	[mm/kN]	0,23		0,08		0,08		0,05		0,13
Displacement under seismic action C2 [1] **unfilled** annular gap											
Effective anchorage depth	$h_{ef} \geq$	[mm]	40	45	40	60	50	70	65	85	90
Displacements for DLS	$\delta_{V,C2(DLS)}$	[mm]	2,8	3,0	3,4	3,5	3,5	4,2	3,8	4,4	5,1
Displacements for ULS	$\delta_{V,C2(ULS)}$	[mm]	5,2	5,1	7,0	8,4	7,5	11,8	7,8	11,1	9,4
Displacement under seismic action C2 filled annular gap											
Effective anchorage depth	$h_{ef} \geq$	[mm]	40	45	40	60	50	70	65	85	90
Displacements for DLS	$\delta_{V,C2(DLS)}$	[mm]	0,9	0,6	1,2	0,5	1,5	1,5	1,6	1,6	4,1
Displacements for ULS	$\delta_{V,C2(ULS)}$	[mm]	2,5	2,6	5,4	3,6	6,0	7,1	6,2	6,2	8,4

[1] For anchorages with clearance in the fixture the annular gap must also be taken into account

ICCONS® THRU-BOLT™ ULTRA / ULTRA A4 / ULTRA HCR

Performance
Displacements under shear load

Annex C10